

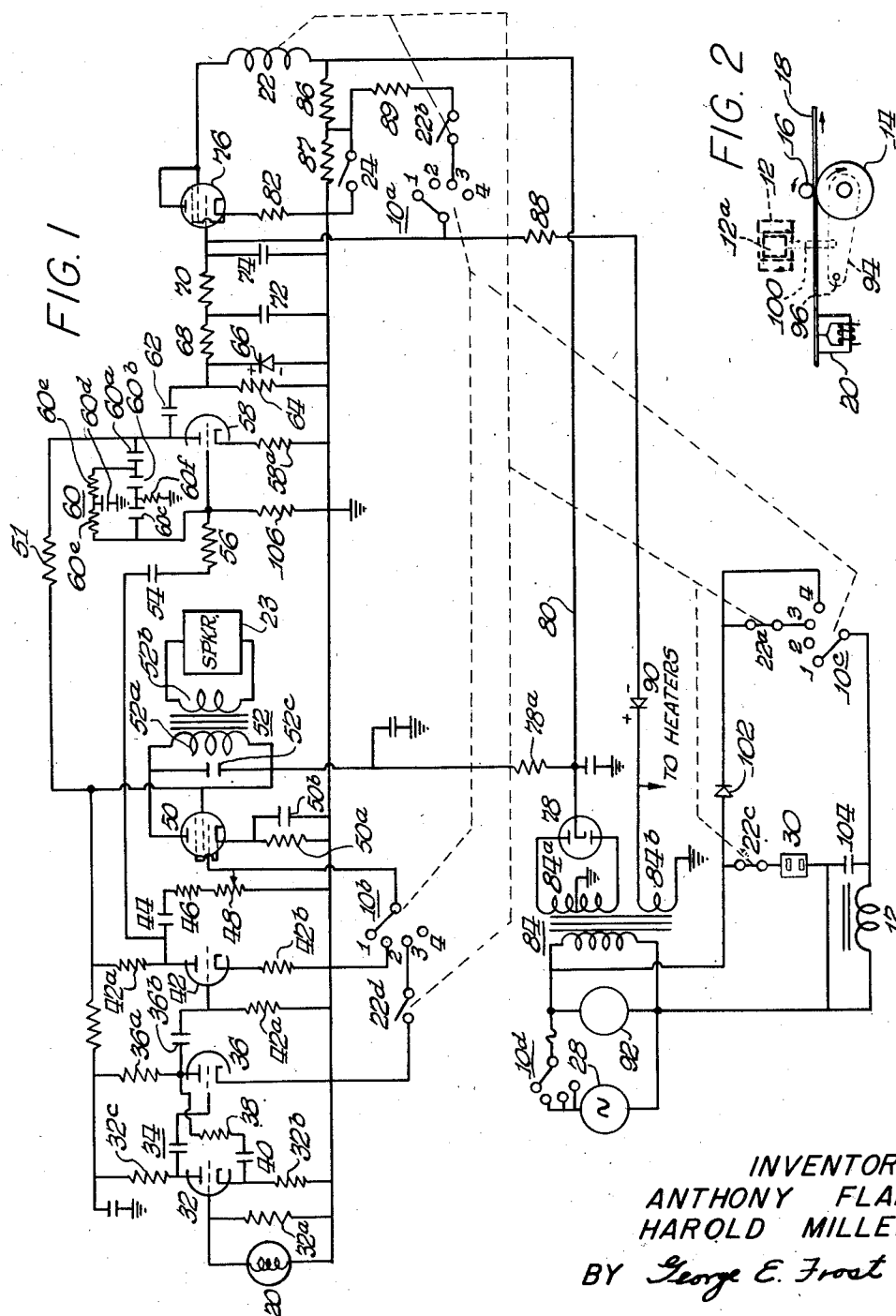
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CONTROL MECHANISM RESPONSIVE TO A RECORDED SIGNAL

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1

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CONTROL MECHANISM RESPONSIVE TO A RECORDED SIGNAL

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Our invention relates to a control mechanism responsive to a control signal superimposed on the main signal recorded on a tape.

It is frequently desirable to provide both the reproduction of sounds recorded on a tape and the performance of control functions as the reproduction proceeds. Thus, for example, it may be desirable to arrest operation of the reproducing mechanism at the end of a play-back, so that an unattended reproducer will play a complete program and then revert to an unenergized condition. In another application it may be necessary to apply or interrupt the power supply to a remote apparatus, such as the automatic slide changer mechanism of a slide projector. In this instance it is necessary to interpose the control operations on the reproducing operation so that the listener observes no change in the sound program, although the projector changes from one slide to the next.

In accordance with the present invention an apparatus is provided to do these and similar operations. In brief, the signal picked up from the tape is amplified and applied to a speaker in the usual fashion. At a signal takeoff point located in advance of the volume control the composite signal is applied to a frequency selective amplifier which amplifies only the selected control frequency, say 25 cycles. The resultant selectively amplified signal is applied to an integrating network for application to the control electrode of the control tube, that electrode being normally held to low space current flow condition by negative bias taken from the low voltage high resistance source. When the control voltage is maintained for a time sufficient to charge the integrating circuit and drive the control electrode of the control tube positively, the current flow increases to the relay pickup value. Depending upon the selected condition of the mechanism, the relay closes and seals in or closes only so long as the control signal is maintained.

The selected condition of the system is determined by the position of a multi-bank multi-position selector switch. In the "manual" position one bank of this switch connects the control electrode of the control tube to a point of positive voltage through normally open relay contacts, thus causing the relay to seal in. The relay may subsequently be deenergized by grounding the point of positive voltage. Also, when the unit is in the "manual" position the solenoid provided to engage the tape drive mechanism is deenergized by reason of a set of normally closed control relay contacts which are connected to another bank on the selector switch, thereby arresting further travel of the tape over the reproducing head.

When the unit is set in the "automatic" position, the selector switch interrupts the relay seal-in circuit and additionally defines a solenoid energizing circuit independent of relay pickup. Accordingly, the tape continues to wind and the relay is only momentarily energized by the control signal.

Provision is made for limiting the response of the control tube to random bursts of signal containing substantial control frequency components. In part this response

2

limiting action is obtained from a time delay or integrating circuit. Additionally, negative bias imposed on the control tube assures that operation will take place only in the presence of a control signal of substantial magnitude. During relay operation the negative bias on the control tube is overcome by a source of positive voltage.

It is therefore a general object of the present invention to provide an improved control mechanism responsive to a control signal of non-audible frequency recorded on a tape.

A further object of the present invention is to provide a positive acting control system responsive to a relatively low frequency, such as 25 cycles.

Still another object of the present invention is to provide an improved control system responsive to a non-audible control signal which does not respond to signal bursts having substantial control frequency components.

Yet another object of the present invention is to provide an improved apparatus responsive to a control signal recorded on tape, which apparatus positively seals in and yet may be positively started from the seal-condition.

Still another object of the present invention is to provide an improved apparatus responsive to control signal which may be selectively set either to seal-in the triggered condition or, alternatively, to remain in that condition only so long as control signal is present.

Additionally it is an object of the present invention to provide an improved highly flexible device adapted to reproduce the signal on a tape and at the same time perform control functions in response to a control signal of predetermined frequency on the tape, such device being simple, reliable, inexpensive, positive acting, flexible, and readily manufactured to the end that a mechanism suitable for a wide variety of commercial advertising, lecturing and other purposes is obtained.

The novel features which we believe to be characteristic of our invention are set forth with particularity in the appended claims. Our invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a schematic circuit diagram of a controlled tape reproducer constructed in accordance with the present invention; and

Figure 2 is a fragmentary diagrammatic top plan view of the mechanical mechanism of the unit of Figure 1.

General construction and operation

The reproducer shown in Figure 1 includes a four-position manual selector switch which has four banks of contacts indicated generally at 10a, 10b, 10c and 10d. Each of these has a single contact arm movable selectively to one of each of four fixed contacts. The arms are mechanically connected to be rotated in unison by means of a suitable knob. The four positions of the selector switch indicated at 1, 2, 3 and 4 at each set of contacts on Figure 1 are, respectively "off," "standby," "manual" and "automatic." In the "off" position selector switch bank 10d interrupts the supply of energizing power from source 28 to the complete unit. Accordingly, the capstan drive motor 92 does not rotate; the amplifier power transformer 84 is not energized; and the pinch roller pull-in solenoid 12 does not pull that roller to tape-engaging position.

In the "standby" position of the selector switch the switch bank 10d energizes the motor 92 and the power transformer 84. At this time the solenoid 12 remains deenergized since its energizing circuit through selector switch bank 10c is open. Accordingly the pinch roller 14

is not pulled into tape-engaging position and the tape 18 is not moved over the reproducing head 20 even though capstan 16 is rotating. An amplifier muting circuit is defined by the selector switch bank 10b so that extraneous and pickup noises are not reproduced in the speaker 23.

When the selector switch is on "manual," the pinch roller pull-in solenoid 12 is energized through the normally closed contacts 22a of the control relay 22 and bank 10c of the selector switch. When a control signal appears, the control relay 22 is energized to open these contacts and thereby deenergize solenoid 12. The control relay 22 seals-in by reason of the action of normally open contacts 22b so that the pinch roller pull-in solenoid 12 remains deenergized and the tape 18 comes to a stop until the unit is reset by momentary closing of the manual start switch 24.

When the selector switch is in the "automatic" condition, the pinch roller pull-in solenoid 12 is permanently energized through the number 4 contact of portion 10c of the selector switch. The tape 18 is accordingly in continuous movement irrespective of the condition of relay 22. With this setting a control signal energizes relay 22 only while the control signal is present and for a short time thereafter. At all other times the relay 22 is deenergized.

The normally closed contacts 22c of the control relay 22 control the application of power from source 28 to the female appliance socket 30. The socket receives an appliance plug to an automatic slide projector or other device desired to be controlled in response to the condition of the relay 22.

Construction

The amplifier defined by vacuum tube 32 amplifies the voltages induced in the magnetic pickup head 20 by travel of the recorded magnetic tape 18, Figure 2, thereafter. These amplified signals are applied through capacitor 34 to the second amplifier defined by vacuum tube 36. The anode of tube 30 is connected back in a negative feedback circuit to the cathode of tube 32 through resistance 38 and capacitor 40 which serve as an equalizing network so that the signal appearing in the anode of tube 36 is a faithful reproduction of the sound initially recorded on tape 18.

The signals at the anode of tube 36 are further amplified by vacuum tube 42 and are applied through the network defined by capacitor 44, resistance 46 and potentiometer 48 to the power amplifier pentode electron tube 50. The potentiometer 48 serves as a volume control. The anode-cathode space current of the tube 50 passes through the primary winding 52a of the output transformer 52. The secondary winding 52b feeds the alternating components of this current to the speaker 23 in a proper impedance match to reproduce in audible form the signals recorded on tape 18.

The selector switch bank 10b defines a grounding circuit for the movable arm of potentiometer 48. This circuit is always effective in the number 2 contact position and in the number 3 contact position is effective through the normally open contacts 22d of relay 22.

Signals at the anode of tube 42 are also applied through capacitor 54 and resistance 56 to the amplifier tube 58. The anode of tube 58 is connected in negative feedback relation to the control electrode by the network shown generally at 60. As is hereinafter described, this network is characterized by a high impedance between the anode and the control electrode at the frequency of the control signals, such as 25 cycles. Accordingly, there is little or no negative feedback for such signals and the full amplifier gain is available. As to all other signals, however, the network 60 provides a comparatively low impedance feedback path which reduces the amplification of tube 58 to a point wherein the signals at its anode are too small to actuate the relay 22 as hereinafter described.

Output voltage from the tube 58 is taken through capacitor 62 and resistance 64. This voltage is rectified

by the rectifier 66 to provide at the junction of resistance 64 and capacitor 62 a series of half-wave rectified 25 cycle pulses when the control signal is present and otherwise no substantial signal.

The filter defined by resistances 68 and 70 and capacitors 72 and 74 serves as an integrating network to prevent short momentary signals across resistance 64 from reaching the control electrode of the relay control tube 76.

The anode current of control tube 76 is passed through the relay winding 22 as shown. This circuit may be traced from the cathode of rectifier 78 through conductor 80 to the relay winding 22 and thence through the anode-cathode space path of tube 76, and cathode resistance 82 back to ground and to the center tap of the high voltage winding 84a of power transformer 84.

The high voltage end of the control relay winding 22 is connected to ground through the series resistances 86 and 87. The resistance 87 may be short circuited by the manual start switch 24 to reduce the current flow in tube 76 and causes relay 22 to drop out as hereinafter described. The common connection of resistances 86 and 87 is also connected through switch contacts 22b and contact 3 of the selector switch bank 10a to the control electrode of tube 76. Negative bias voltage is also applied to the control electrode through resistance 88 and half-wave rectifier 90, this voltage being taken from the heater supply winding 84b of the transformer 84.

The capstan drive motor 92 is connected across the power supply source 28 through the bank 10d of the selector switch. The source 28 is the usual 117 volt 60 cycle service supply.

The pinch roller 14, Figure 2, is mounted on and carried by the rockable arm 94 which is pivotally supported at 96 for swinging movements into or out of engagement with the capstan 16. The pinch roller engaging solenoid plunger 12a is linked by link 100 to the swingable arm 94 so that when the solenoid 12 is energized the plunger 12a is drawn into the solenoid and the pinch roller 14 is pulled snug against capstan 16. The pinch roller is constructed of rubber-like material to force the tape 18 against the capstan 16 in effective gripping action. When the solenoid is not energized the pressure of the tape against the capstan requisite for tape-driving engagement is not present and the tape is accordingly not driven by the capstan 16.

The rectifier 102 and capacitor 104 serve to rectify the voltage of source 28. This rectified voltage appearing across capacitor 104 is applied through normally closed contacts 22a of relay 22 and through the selector switch bank 10c to the solenoid 12a as shown.

In a unit constructed in accordance with the present invention and using the circuit shown in Figure 1, the component parts are as follows:

Resistance 32a	3.9 megohms.
Resistance 32b	330 ohms.
Resistance 32c	470,000 ohms.
Capacitors 40 and 44	470 micromicrofarads.
Resistance 38	680,000 ohms.
Resistance 36a	470,000 ohms.
Capacitor 36b	0.01 microfarads.
Resistance 42a	470,000 ohms.
Resistance 42b	4700 ohms.
Resistance 46	470,000 ohms.
Potentiometer 48	250,000 ohms.
Resistance 50a	270 ohms.
Capacitor 50b	20 microfarads.
Capacitor 52c	.005 microfarads.
Resistance 51	100,000 ohms.
Capacitors 54, 60a, 62, 72 and 74	0.1 microfarads.
Resistances 56, 68 and 70	1 megohm.
Capacitors 60b and 60c	.01 microfarads.
Resistance 60e	680,000 ohms.

Capacitor 60d	0.022 microfarads.
Resistance 60f	220,000 ohms.
Resistance 58a	1000 ohms.
Resistance 64	1.5 megohms.
Resistance 82	1500 ohms.
Resistance 87	6800 ohms.
Resistance 86	100,000 ohms.
Resistance 89	1 megohms.
Resistance 88	3.9 megohms.
Resistance 78a	1000 ohms.
Tubes 32 and 36	One 12AX7 tube.
Tubes 42 and 58	One 12AX7 tube.
Tube 50	6AQ5.
Tube 76	6AU6.
Relay 22	Pull-in 8 to 9 milli- amperes; dropout 6 to 7 milliam- peres.
Normal voltage at conductor 80	300 volts D.-C.

Detailed operation

The operation of the speaker energizing system extending from pickup head 20, through electron tubes 32, 36, 42 and 50 is conventional. The current flow in winding 52b is in accordance with the recorded sound on the tape, thereby causing speaker 23 to reproduce those sounds. The volume of the sounds so reproduced is determined by the position of the potentiometer 48.

When the selector switch is in the "standby" position the movable arm of bank 10b engages the fixed contact 2. This grounds the movable arm of potentiometer 48 to mute the speaker 23 since by this action no time varying signal can reach the speaker. When the selector switch is in the "manual" position, the fixed contact 3 of bank 10b is engaged by the movable arm thereof to form a muting circuit for the control electrode of tube 50 through the normally open relay contacts 22d. Accordingly, tube 50 and speaker 22 are muted when the unit is in manual position and the relay 22 is energized and at all other times the operation is normal.

The control signal is taken from the anode of tube 42 through capacitor 54 and resistance 56 to appear across the resistance 106. This signal is a composite signal including both the sound components of the recorded signal and the control components, if present. As is above described, the control component may be a signal outside of the audible range. In practice, 25 cycle signals have been used for this purpose, although other frequencies may be used if desired.

The electron tube 58 serves to amplify selectively the composite signal across resistance 106. At the selected control frequency, such as 25 cycles, the feedback network 60 has comparatively high impedance. This permits the electron tube 58 to amplify with its normal and usual amplification. For example, with a 12AX7 tube in the circuit shown, the amplification factor is about 100 so that gain may be of the order 20 decibels for 25 cycle signals. On the other hand, for signals of substantially different frequency the comparatively low impedance of the feedback network 60 provides such a large amount of negative feedback that the amplification of tube 58 is substantially less than unity, so that such signals do not appear at the anode of tube 58. As a consequence, the signals across capacitor 62 and resistance 64 are of very low magnitude in comparison to the magnitude of the 25 cycle or other selected control frequency.

The resistance 64 is short circuited by the rectifier 66. Accordingly only the positive half of each 25 cycle wave appears across that resistance. Each such half wave charges capacitor 72 through resistance 68. This charging circuit may be a time constant of the order of $\frac{1}{10}$ second so that a succession of 25 cycle pulses is required. As the capacitor 72 charges it in turn charges capacitor 74 through resistance 70. Resistance 70 and capacitor

74 may be, for example, $\frac{1}{10}$ second time constant, giving further integrating action and requiring a still longer series of pulses before the voltage rises significantly. The net effect is to produce across capacitor 74 a substantial voltage only when the 25 cycle control signal is maintained for a substantial time period such as, for example, $\frac{1}{2}$ second.

The network defined by capacitors 72 and 74 and resistances 68 and 70 serves to isolate the control electrode of tube 76 from momentary bursts of 25 cycle energy. This energy may occur, for example, by reason of normal variation in the recorded sound, such as music. Since the tube 76 is to be energized only by the desired sustained control signals, the network serves the useful purpose of preventing the false operation that might otherwise take place.

The space path current flow for tube 76 passes through the energizing winding of relay 22. The current flow path may be traced from the cathode of rectifier 78 through conductor 80 and winding 22 to the anode of tube 76. The cathode of tube 76 is connected through resistance 82 to the ground and thence to the center tap of winding 84a of power transformer 84. The high voltage side of winding 22 is connected through resistances 86 and 88 to ground, thus defining a point of intermediate potential at the junction of these resistances.

In the absence of control signal, the tube 76 is biased to a relay dropout current flow by reason of the negative bias obtained from power transformer winding 84b. This is the heater current supply winding which may, for example, produce 6.3 volts R. M. S. This voltage is applied through half-wave rectifier 90, resistance 88 and the resistances 78, 63 and 64 to ground and thence to the grounded terminal of winding 84. The control electrode of tube 76 has accordingly about half of the available negative bias voltage. Capacitors 72 and 74 serve as filter capacitors to hold the control electrode voltage of tube 76 substantially constant during the time intervals between successive cycles of the 60 cycle voltage of winding 84b. This negative bias voltage, together with the biasing action of resistance 82, serves to maintain the current flow in tube 76 below the relay dropout current when there is no signal at the control electrode of tube 76.

When control signal is present a positive signal voltage is applied to the control electrode of tube 76 thus swinging the control electrode in direction to increase the anode-cathode space current. If the control signal is of sufficient amplitude and duration this positive swing proceeds to a voltage value sufficient to cause cathode-anode current flow capable of picking up the relay 22. When the selector switch is in the number 3 position, this relay thereupon seals in the energized state since the contacts 22b close to bring the control electrode of tube 76 to the potential at the junction of resistances 86 and 88 which is, for example, about 15 volts positive. Simultaneously, the bank 10b of the selector switch makes contact through the number 3 contact and the contacts 22d to ground, thereby bringing the movable terminal of potentiometer 48 to ground potential and muting the speaker 23. Additionally, the bank 10c of the selector switch makes contact through the number 3 contacts to the normally closed contacts 22a of relay 22 which, when energized, open contact. This removes the energizing voltage from pinch roller engaging solenoid 12 and thereby releases the arm 94, Figure 2. Without the solenoid pull on arm 94 the pinch roller 43 is not subjected to the pressure required to bring the tape 18 into driving engagement with the capstan.

By the above described sequence of events, the control signal arrests all further operation of the unit. At the same time, however, the unit is placed in a standby condition with the capstan 16 turning and the amplifier circuits in the warmed up condition. When it is desired to restore operation, the manually operated switch 24 is momentarily closed. This reduces the control electrode

of tube 76 to negative potential through the bank 10a of selector switch 10 (now in the number 3 position), the normally open contacts 22b of relay 22, and the voltage divider formed by resistance 89 (which connects to ground potential) and resistance 88 (which connects to the negative potential of rectifier 90). Since at this time the control electrode of tube 76 is firmly brought to negative potential, the relay 22 positively drops out.

When the selector switch banks 10a, 10b and 10c are in the number 4 position the seal-in circuit for relay 22 through the normally open contacts 22b is ineffective since it is open at contact number 4 of the relay bank 10a. Consequently, the relay 22 is closed only when a control signal voltage is applied to the tube 76 and it opens as soon as the positive control signal voltage disappears at the control electrode of that tube. Moreover, the solenoid 12 is under this condition energized directly through the number 4 contact of relay bank 10c independently of the condition of relay 22. As a consequence the solenoid 12 remains energized despite the presence of control signal and the pinch roller 14 is held against capstan 16 to maintain the forward movement of the tape 18. The induced signal in the head 20 accordingly continues. It will be observed that in the number 4 position of selector switch, the bank 10b defines an open circuit so that closure of the relay contacts 22d gives rise to no muting effects.

When the selector switch is in the number 2 position, the pinch roller 14 is not subject to pressure due to the solenoid 12 and the tape 18 is accordingly not moved. This results from the fact that the number 2 selector switch contact in bank 10c is not connected to a source of solenoid operating energy.

It will be noted that the normally closed relay contacts 22c supply power to the female appliance socket 30. This socket may, for example, receive a mating plug to energize a slide projector mechanism of the type which advances a new slide to position whenever power is momentarily interrupted. With this arrangement the control signal on the tape 18 momentarily deenergizes the socket 30 when the unit is in the "automatic" position. This is desirable, for example, where the tape 18 includes a narrative which is illustrated by a sequence of slides, for the narrative continues uninterrupted while the slides are changed automatically at the desired times. If desired, contacts 22c may be of the normally open type, in which event the socket 30 is energized when control signal is present. Alternatively, additional contacts may be provided on the relay 22 to perform switching operations if desired.

When the unit is adjusted to the "manual" condition the tape 18 may, for example, be a continuous loop tape and the signal recorded at the end of each complete rendition. The manually operated switch 24 may in this instance be a push button to be actuated by the listener desiring to hear one complete cycle of the program. Alternatively, switch 24 may be automatically operated, as by a photo-electric system, so that when a patron interrupts a light beam the program is automatically initiated. It will be noted that in this connection the closure of switch 24 produces no sound at the speaker 22 since the speaker is muted and does not otherwise interrupt operation of the unit.

In the above description the bank 10d is shown on the selector switch to deenergize the unit when the switch is in the number 1 position. Alternatively, the switch may have a on-off switch which is actuated to "on" position by shaft rotation prior to the time switch positions 2, 3 and 4 are reached.

It will be noted that the resistance 88 defines a high impedance bias voltage source to the control electrode of tube 76. Because of this impedance, the signal voltage coming from tube 58 to the capacitor 74—which itself has in effect a rather high internal impedance—is capable of varying the control electrode voltage of tube 76.

In the actual construction described above the no-signal voltage at the control electrode of tube 76 may range from about 2 to 5 or more volts negative; the voltage in the presence of signal was about 12 volts positive; and the voltage at seal-in with the selector switch at the "manual" position was about 12 volts positive. All of these voltages may vary within wide limits. Indeed, this is one of the advantages of the apparatus of the present invention, which operates positively and effectively over wide variations in the components and conditions of operation. This not only permits a less expensive construction but in addition makes the control operation more positive. Under this operation the tube 86 draws about 3 milliamperes in the normal state and in the presence of control signal or the seal-in it draws about 10 milliamperes.

The capacitor 104 has a relatively large capacitance, such as 100 microfarads. This delays the release of the solenoid 12 for a predetermined time period after the operation of switch 22a would otherwise release that solenoid. This operation additionally serves to make the unit operate in a positive fashion since there is otherwise a chance that the tape 18 will come to rest at a point where the control signal is still on the tape. If this happens the momentary closure of switch 24 will only start the unit which will immediately stop because of the control signal on the tape. The delaying action of capacitor 104 causes the tape to continue its motion after the first actuation of relay 22 so that the portion bearing the control signal (for example, a three inch length) completely clears the head 20.

In operation, the current flow from rectifier 102 charges the capacitor 104 prior to and while the solenoid 12 is picking up. So long as the solenoid 12 remains energized this charge remains on the capacitor. When switch 22a opens (or switch 10 is reset) the capacitor 104 discharges through solenoid 12, which gradually exerts less and less force on the arm 94 and pinch roller 14 until the force falls to negligible tape-releasing value, at which time the tape stops.

While we have shown and described a specific embodiment of the present invention it will, of course, be understood that numerous modifications and alternative constructions may be made without departing from the true spirit and scope thereof. We therefore intend by the appended claims to cover all such modifications and alternative constructions as fall within their true spirit and scope.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A reproducing and control device operable to reproduce the audible signal on a recording and to perform control operations in accord with control signals of predetermined frequency on the tape, the device comprising: a pickup head; means operable when energized to draw the tape over the head; a sound amplifier adapted to reproduce signals picked up in the head; a speaker responsive to the amplifier output; a control signal amplifier connected to the sound amplifier at a predetermined point and including frequency selective elements operable to suppress signals of frequency other than control frequency; means to rectify the output of the control signal amplifier; a resistor and capacitor connected across said last means to define an integrating circuit; an electron tube having a cathode, anode, and control electrode; means to supply cathode-anode space voltage to the said tube; relay means responsive to the cathode-anode space current of said tube, said relay means having at least two sets of normally open contacts and one set of normally closed contacts; a selector switch having at least three banks and three sets of contacts; means including one of said selector switch banks in one selector switch position to connect the control electrode of the tube through one set of normally open relay contacts to a point of positive potential, whereby the relay seals in upon actuation at said one selector switch position; means including another

of said selector switch banks in said one selector switch position to connect a point in said amplifier after said first mentioned point to ground, whereby the sound amplifier is muted upon relay actuation at said one selector switch position; and means to energize said first means through a third selector switch bank and the normally closed relay contacts when the selector switch is in said one position and directly through the said third selector switch bank when the selector switch is in another position.

2. A control mechanism for use with a tape reproducer having a drive mechanism operable when energized from a voltage source to drive the tape over a reproducing head, the control mechanism being responsive to a non-audible signal recorded on the tape and selectively operable to assume a quiescent state either permanently or momentarily when a control signal appears, the mechanism comprising: an electron tube having cathode, anode and control electrodes; a relay having normally closed and normally open contacts and an actuating winding; a source of unidirectional voltage; means connecting said source to the anode-cathode space path of said tube through the actuating winding of the relay; means to apply the control signal in positive sense to the control electrode; resistance means operable to apply predetermined negative bias voltage to the tube, whereby the relay remains open in the normal state and picks up when the control signal is applied to said tube; a selector switch having at least two banks and at least two positions on each bank; means connecting the control electrode of said tube to said unidirectional voltage source through one set of contacts of one bank of said selector switch and in series with the normally open relay contacts and a resistance; means operable to energize said drive mechanism through the corresponding contacts of the other bank of the selector switch and the normally closed relay contacts; means directly connecting said drive mechanism to said last means directly through other contacts of the said other bank of the selector switch; and means selectively operable to connect said last-mentioned resistance to ground.

3. A control system responsive to a periodic sub-audible comparatively long control signal superimposed on a main signal having signal bursts containing control frequency components, the system comprising: frequency selective means operable to pass the control signal while rejecting signals of other frequencies; means to rectify the output of said first means; integrating means responsive to the output of said second means; an electron tube having a cathode, anode and control electrode; means to apply the output of said integrating means to the control electrode-cathode space path of the tube; biasing means having substantial effective internal resistance operable to bias the control electrode in the negative sense in relation to the cathode whereby in the normal condition the tube has a predetermined small cathode-anode space current; means to apply positive anode-cathode space path voltage to the said tube; relay means responsive to the anode-cathode space path current of said tube and operable when energized by predetermined large current to apply a positive potential to the control electrode of the tube, thereby sealing in the energized condition and overcoming the biasing means; and means selectively operable to destroy said positive potential to bring the control electrode to cathode potential and cause the relay means to drop out.

4. A control system responsive to a periodic sub-audible comparatively long control signal superimposed on a main signal having signal bursts containing control frequency components, the system comprising: frequency selective means operable to pass the control signal while rejecting signals of other frequencies; means to rectify the output of said first means; a capacitor and resistance in series across said last means to define an integrating circuit; a source of alternating E. M. F.; means connecting said source through a half-wave rectifier and a resistance to charge said capacitor in sense opposite to the charge of

the control signals; an electron tube having cathode, anode, and control electrodes; means connecting the cathode and control electrode of said tube across said capacitor so that the control electrode is normally biased negative in relation to the cathode while control signals swing the control electrode in the positive direction in relation to the cathode; means to apply cathode-anode space path voltage to the said tube; and means responsive to the cathode-anode space path current of the tube.

5. A control mechanism responsive to a non-audible control signal interposed on a main signal, the mechanism comprising in combination: means operable to separate the control signal from the main signal; integrating means responsive to the duration of the control signal; an electron tube having cathode, anode and control electrodes; an operating relay having a winding and a pair of normally open contacts; a source of unidirectional E. M. F.; means connecting said source to the cathode-anode space path of the tube through the relay winding; means connecting said integrating means to the control electrode of said tube, whereby control signal maintained for a predetermined period causes the tube to draw relay pickup current; means operable to supply a predetermined negative bias voltage to the control electrode of said tube, said means having substantial resistance and normally maintaining the space current in the tube to a predetermined value below relay actuating current; means including said normally open contacts connecting the control electrode of said tube to a point of positive potential, whereby the relay seals in the actuated condition; and means selectively operable to reduce said point to a low potential to cause the relay to drop out.

6. A control mechanism responsive to a non-audible control signal interposed on a main signal, the mechanism comprising in combination: means operable to separate the control signal from the main signal; integrating means responsive to the duration of the control signal; an electron tube having cathode, anode and control electrodes; an operating relay having a winding and a pair of normally open contacts; a source of unidirectional E. M. F.; means connecting said source to the cathode-anode space path of the tube through the relay winding; means connecting said integrating means to the control electrode of said tube, whereby control signal maintained for a predetermined period causes the tube to draw relay pickup current; means operable to supply a predetermined negative bias voltage to the control electrode of said tube, said means having substantial resistance and normally maintaining the space current in the tube to a predetermined value below relay actuating current; means including a series resistance and said normally open contacts connecting the control electrode of said tube to a point of positive potential, whereby the relay seals in the actuated condition; and means selectively operable to reduce the positive potential at said point to zero, thereby providing voltage divider action imparting negative bias to the control electrode of the tube and positively causing the relay to drop out.

7. A reproducing device for an elongated record medium wherein a recorded control signal of predetermined duration arrests movement of the medium, the device including: means to reproduce signals from the medium as it travels thereover; electrical drive means having a pair of terminals operable in response to predetermined unidirectional E. M. F. across said terminals to drive the medium in signal-reproducing movements; means to supply said E. M. F. and operable in response to reproduction of the control signal to discontinue said E. M. F.; and, a capacitor connected across said terminal and of size to maintain the movement of the record medium for a sufficient time after loss of said E. M. F. to cause the full signal-bearing length of said medium to travel past the said first means so that subsequent reproduction from the medium is free of the control signal.